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Pricing in the World Feed Grain Market [1]

By Alex F. McCalla

CONTINUING ATTENTION is being given to possible international arrangements in the Temperate Zone for grain-livestock trade. Such arrangements may be more meaningfully derived if a knowledge of past and present pricing arrangements is available. This article reports an attempt to formulate a conceptual framework useful in exploring past feed grain price behavior and for suggesting important variables, structural and behavioral, likely to affect future price movements.[2] Not surprisingly, the United States emerges as the dominant pricing factor in the world market.

The Nature of the Feed Grain Market

Taken as a group, feed grains (corn, barley, oats, millets and sorghums, and mixed grains) occupy twice as much acreage as wheat and yield more than twice the volume.[3] Nearly 30 percent of world wheat production enters international channels, but only about 8 percent of feed grain production enters these channels.[4] However, only about half of feed grain production enters any market channel (the remaining half is fed on farms where it is grown). This means that about 16 percent of marketed feed grains enter world markets. Corn constitutes 50 percent of world trade, barley 25 percent, and other grains the remainder. The volume of feed grain trade has risen rapidly in the last 15 years.

The majority of the trade in feed grains consists of exports from the Americas to Western Europe. The United States exports approximately 55 percent of the corn, 20 to 25 percent of the barley, 10 to 30 percent of the oats, and 70 to 75 percent of the millets and sorghums entering world trade. Argentina exports 12 to 18 percent of the corn, 10 to 15 percent of the oats, and 15 to 18 percent of the millets and sorghum. Canada in some years is a substantial exporter of barley and oats but an importer of corn. Australia, the U.S.S.R., and the Union of South Africa are the other major exporters. The European Economic Community (EEC) imports 40 percent of the corn, 40 percent of the barley, 60 percent of the oats, and about 40 percent of the millets and sorghums entering world channels. The European Free Trade Association (EFTA), of which the United Kingdom is the dominant importer, accounts for about 20 percent of the corn, 15 percent of the barley, 20 percent of the oats, and 15 percent of the millets and sorghums entering trade. Japan is the only other major importer of feed grain. In summary, then, the United States exports more than 50 percent of all feed grains entering world trade, while the EEC and the United

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[2] For a similar attempt with respect to wheat, see Alex F. McCalla, "A Duopoly Model of World Wheat Pricing," Jour. Farm Econ. Vol. 48, No. 3, part 1, August 1966, pp. 711-727.

[3] See Food and Agriculture Organization of the United Nations (FAO), The Stablization of World Trade in Coarse Grains, Commod. Policy Study 14, Rome, 1963, table 1. Coarse grains include the feed grains listed above plus rye. The relatively minor importance of rye in production and trade makes the distinction unimportant.

[4] See FAO, The Stabilization of World Trade . . ., table 6, p. 20.

Kingdom import more than 60 percent of all feed grains.[5]

The Complexity of the Feed Grain Sector

A conceptualization of the world feed grain market, which is an aggregation of surpluses and deficits from domestic feed grain sectors, is made difficult by three factors: (1) Feed grains are not a homogeneous product, though their similarities with respect to livestock feed use require joint treatment; (2) the demand for feed grains is a conglomerate of direct demand for food and industrial uses and derived demand for feed uses; and (3) in contrast with wheat and meats, large proportions of feed grain production never enter market channels.

Recent studies indicate a high degree of substitutability among the various grains classified as feed grains.[6] The FAO study suggests that the high interchangeability among feed grains for feeding purposes results from "the common nutrition properties and the similar content of net energy value in various grains . . ." which makes possible the compounding and feeding of grain rations of widely varying composition to the same types of livestock in different countries with generally satisfactory results.[7] The FAO report concludes that the major factor determining substitution is the relative price of various grains. Given this high degree of substitutability, it follows that prices of various feed grains move together over time,[8] though short-term variations among feed grains may occur as a result of variations in the supplies of individual feed grains.[9] In the following analysis, secular movements in prices of corn--the dominant traded feed grain--are assumed to be representative of feed grain prices.

The final demand for feed grains is a composite of direct demand for food, industrial and export uses, and derived demand for feed grains. During 1958-61, 66 percent of the total world feed grain production was used for livestock feed, 24 percent for food, and 4 percent for industrial purposes; while 6 percent went for seed, wastes, and losses.[10] It is likely, however, that the proportion of feed grain production utilized in livestock feeding is substantially higher in the developed nations under study here. Table 1 shows the allocations of U.S. feed grain output to various uses. The combined feed and export use in 1965 was 94.1 percent, an increase over the 1959-63 average of 91.0 percent. These data also suggest an increase over time in the proportion of feed grains used for livestock purposes. Foote, Klein, and Clough[11] found that the nonfeed uses of corn from 1921 to 1942 were nonresponsive to price changes. These two factors--the high and rising proportion of production utilized for feeding purposes and the nonresponsiveness of nonfeed uses to price changes--tend to justify the assumption that the domestic and international demand for feed grains is predominantly a demand derived from the demand for meat.

The demand-supply situation with respect to feed grains is further complicated by the fact that only about half of feed grain production enters market channels, while the other half is fed on the farm where it is raised.[12] The pro-

[5] These percentages are derived from data in the FAO Trade Yearbook, Vols. 1-18, 1947-1964.

[6] See FAO, The Stabilization of World Trade . . ., p. 6; also the study of the British feed industry in appendix B, Ibid., pp. 1-24; and R. J. Foote, J. W. Klein, and M. Clough, The Demand and Price Structure for Corn and Total Feed Concentrate, U.S. Dept. Agr., Tech. Bul. 1061, Oct. 1952, p. 21.

[7] Depending on relative prices, soft wheat may become substitutable as a feed grain. However, nearly all wheat entering international trade is for human consumption. For this reason, feed-wheat relationships are disregarded in this analysis.

[8] Foot, Klein, and Clough, loc. cit.

[9] See Kenneth W. Meinken, The Demand and Price Structure for Oats, Barley, and Sorghum Grains, U.S. Dept. Agr., Tech. Bul. 1080, Sept. 1953, pp. 65-74.

[10] FAO, The Stabilization of World Trade . . ., p. 4; also see FAO, "Grains: Recent Trends in Utilization," Monthly Bul. Agr. Econ. and Statis., Vol. 11, May 1962, pp. 6-9.

[11] Foote, Klein, and Clough, op. cit., pp. 19-20.

[12] FAO, The Stabilization of World Trade . . ., table 7, p. 22, for proportions marketed in selected countries. In 1965, the U.S. proportions used on farms were: corn, 25 percent; oats, 68 percent; barley, 26 percent; and sorghum grain 24 percent (U.S. Dept. Agr., Feed Situation, ERS, June 1966, p. 13).

Table 1.--U.S. feed grain production and utilization, average 1959-63 and 1965

Commodity and years	Production	Utilization as percent of production		
		Livestock feed	Food and industrial	Exports
Corn:	*Mil. bu.*	*Percent*	*Percent*	*Percent*
Average 1959-63.....	3,818	82.0	7.6	9.8
1965.....	4,171	77.2	8.0	17.4
Oats:				
Average 1959-63.....	1,044	87.5	3.9	2.4
1965.....	959	79.8	4.6	3.6
Barley:				
Average 1959-63.....	418	58.4	22.2	20.3
1965.....	412	56.1	[1] 24.8	17.0
Sorghum grain:				
Average 1959-63.....	550	74.9	2.0	17.8
1965.....	666	75.8	1.7	[2] 35.5
Total	*Mil. tons*			
Average 1959-63.....	149.0	80.5	7.6	10.5
1965.....	160.7	76.0	7.9	18.1

[1] Reflects rising use as malt.
[2] Reflects reduction of stocks.

Source: U.S. Dept. Agr., Feed Situation, ERS, June 1966, p. 9.

portion marketed varies from region to region, country to country, and grain to grain. Since most of the feed grains used for food, industrial, and export purposes pass through market channels, the relative importance of these uses in commercial sales of feed grains is greater than the disposition data would suggest. In some areas, feed uses of certain grains predominate, for example, corn in rural Argentina; in other areas, industrial uses may predominate, as malting barley does in certain areas of the United States and Canada. It is, therefore, most difficult to arrive at a global statement with respect to the proportion of feed grains marketed. An early study by Phillips[13] has shown that a high percentage of the variation in corn marketed from the North Central region of the United States from 1926 to 1945 was associated with variations in livestock numbers. This result is sometimes projected to argue that marketed feed grains are a residual and that such marketing is not responsive to price. These two characteristics, it is further argued, imply a market which is inherently unstable. If farmers are rational maximizers, however, there is an economic choice as to whether to market corn or feed it. Clearly, the corn-hog cycle is an exemplification of the adjustments farmers make to changing price relationships. Further, since it has been argued that the demand for feed grains is derived from the demand for meat, the choice of the grower-feeder to feed corn is based on the same demand relation as that of a feeder to buy corn.[14] Although it is recognized that the

[13] Quoted in Foot, Klein, and Clough, op. cit., p. 31.

[14] See FAO, The Stabilization of World Trade . . ., ch. 17, for the parallel relationship between animal units, feed grain production, and feed utilization in the United States.

nonmarketed proportion of production contributes to increased instability, for the remainder of this study it is assumed that total feed utilization is a derived function from the demand for livestock products.

The Model

Simplifying assumptions which abstract from detailed reality are made so that a working theoretical model may be developed. These assumptions are examined in the next section of the paper as to their general validity and as to the importance of some exceptions which arise. The following structural assumptions are made:

1. The U.S. market for feed grains is essentially competitive in the sense that trading is conducted by many firms. It is clear, however, that the stocks of feed grains held by the Commodity Credit Corporation (CCC) have constant potential influence on prices in the U.S. market, as does land held out of production by farm programs. But this influence is indirect with respect to export pricing whereas the influence of wheat export subsidies is direct.

2. Given the volume and stock dominance of the United States, the price-setting market for world trade in feed grains is assumed to be the U.S. market. The validity of this assumption will be investigated in detail as the argument proceeds. Net export supplies and net import demands, as determined by world prices and national policies, influence world trade by direct interaction with U.S. domestic supply and demand.

The following behavioral assumptions are made:

1. Nations participating in the international market for feed grains act in a fashion consistent with domestic agricultural programs. In pursuance of domestic objectives, the U.S. Department of Agriculture does, by acquisition or disposal of stocks and the alteration of acreage diversions, attempt to maintain price within a range generally from the loan rate to some policy-determined maximum price which is at least 105 percent of loan rate. The United States can be considered the residual supplier in the world market. This behavioral assumption is based on the fact that the United States has been willing to store current production or dispose of it in other fashions rather than attempt, through price cutting, to sell current production in the commercial export market. Therefore, the United States can be considered as filling the market remaining after other suppliers have dissipated their current production.[15]

2. The international supply of feed grains is a product of competitive agricultural sectors composed of rational profit-maximizing farmers, as modified by domestic agricultural programs.

3. National governments exercise market power as market units only to the extent of their willingness and ability to influence world price behavior.

4. Private traders operating in both domestic and international markets are rational profit maximizers.

Given the assumption that the U.S. market is competitive, and that it is the world price-setting market, the conceptualization of a world demand function, a world supply function, and a world pricing mechanism is outlined.

Consider first the demand side. The major importers of feed grains are the EEC--considered as a unit because of the Common Agricultural Policy (CAP), the United Kingdom, and Japan. Each must be considered separately. Given the nature of the EEC's agricultural policy, the demand for imports is completely inelastic with respect to world price so long as the world price is below the EEC threshold price. This is demonstrated in figure 1(a), where Deec-Deec is the domestic demand as a function of internal prices and Seec-Seec is domestic supply as a function of internal prices. P_0 is equilibrium price in the absence of trade. However, since the EEC is deficient in feed grains at present CAP prices, P_1 is introduced as the threshold and target price (assume these

[15] Argentine corn normally commands a premium over U.S. corn in European markets. This premium reflects quality. The EEC has administratively quantified this premium. When calculating variable levies on corn imports, it deducts a quality premium of $1.25 per metric ton of Plata (Argentine) corn before determining the "standardized" c.i.f. price for corn. The "standardized" c.i.f. price is the subtrahend to be deducted from the threshold price in calculating the variable import levy; see Journal Officiel des Communautes Europeennes, no. 66, p. 1867/62, July 28, 1962.

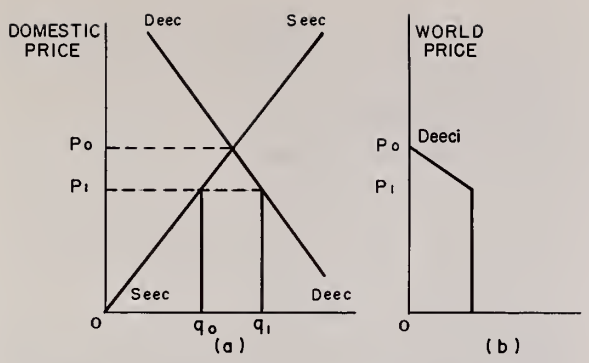

Figure 1.--Derivation of EEC net demand.

prices are the same for this analysis). At P_1, Oq_0 is produced and Oq_1 is demanded; the difference $Oq_1 - Oq_0$ is made up by imports. For world prices below P_1, a variable levy is applied equal to the difference between world price and target price. Thus, for prices below P_1, the import demand for feed grains as a function of world prices is totally inelastic (as shown in figure 1(b)). That is, regardless of the level of world price below P_1, the EEC will purchase only $Oq_1 - Oq_0$. At prices above P_1 but below P_0, import demand is equal to the difference between domestic supply and demand. Thus, Deeci in figure 1(b) represents the demand for imports by the EEC as a function of world price.

In the United Kingdom, where a system of deficiency payments plus minimum threshold prices constitutes feed grain policy, a similar derivation can be made. Given domestic supply and demand functions $S_{uk} - S_{uk}$ and $D_{uk} - D_{uk}$ in figure 2(a), P_0 would be the equilibrium price without trade. If P_1 is the announced support price, then q_1 is produced. The difference

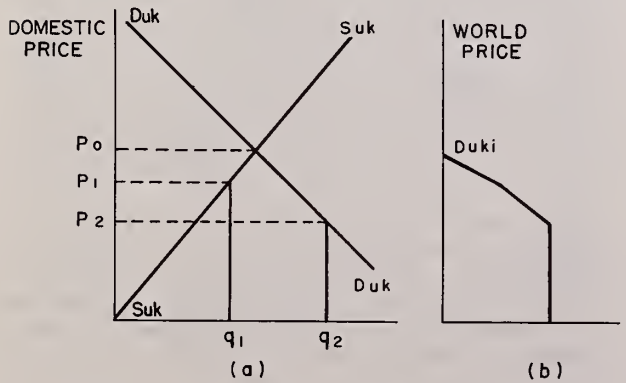

Figure 2.--Derivation of U.K. net demand.

between P_1 and market price is made up by the deficiency payment. If minimum threshold price is P_2, world prices below P_2 have no influence on British price or quantity, thus yielding a perfectly inelastic demand function, as was the case in the EEC (figure 2(b)).

If the world price is between P_1 and P_2, then the segment of the demand curve $D_{uk}-D_{uk}$ between its intersections with price lines P_1 and P_2 is the locus for the intersection with any price line within that range. The perpendicular through such an intersection indicates the total quantity demanded in the United Kingdom. The horizontal difference between such a perpendicular and the perpendicular through q_1 indicates the demand for imports. The import demand function shown in figure 2(b) has three distinct segments resulting from the nature of the United Kingdom's agricultural policy.

In other importing countries such as Japan, which has state trading in small grains and relatively free entry of corn, similar constructions for the derivation of net import demand can be accomplished. Given the assumption that the U.S. feed grain market is the price-setting market for the world, these individual net import demand functions can be added to the U.S. domestic demand to yield a "world demand function."

A symmetrical construction is possible on the supply side. Given domestic supply and demand functions $S_d - S_d$ and $D_d - D_d$ in figure 3(a), in each country equilibrium price without trade is P_0. If world price is above P_0, then export availability is the difference between $S_d - S_d$, and $D_d - D_d$ is depicted in $S_e - S_e$ in figure 3(b). In complete symmetry, and in the absence of

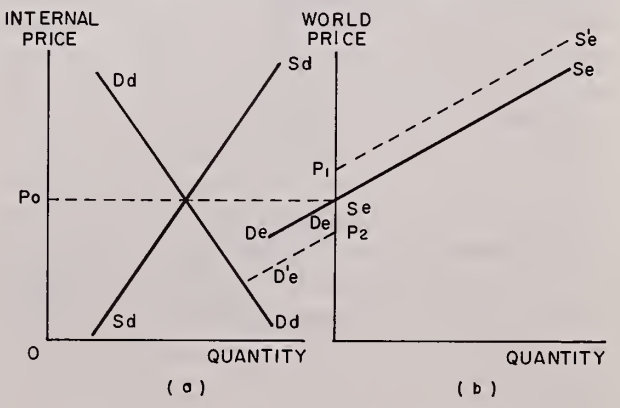

Figure 3.--Derivation of net export supply.

transfer costs or import restrictions, $D_e - D_e$ is a net export demand for world prices below P_0. In reality, the spatial separation of exporters and importers, which results in transport costs, creates a certain price range over which a country is neither an exporter nor an importer. This is shown by the curves $P_1 - S_e'$ and $D_e' - P_2$ where, in figure 3(b), for example, the Argentine market would be isolated from the world market for world prices between P_1 and P_2. Domestic programs, tariffs, and quantitative restrictions also have a tendency to isolate domestic markets. The implication of this discontinuity is that surpluses available for export would be highly variable, given year-to-year variations in domestic supply. Evidence presented later will tend to substantiate this point. The net export supply functions constructed as above can then be added to the U.S. domestic supply function to make a world supply function.

The world supply and demand functions, derived in the above fashion, would interact in the U.S. market to determine a world equilibrium price. But the nature of U.S. domestic farm policy introduces an additional price-influencing factor into the market. Given the first behavioral assumption above, the Commodity Credit Corporation has potential market power through acquisition and disposal of stocks of feed grains and, in the longer run, by alterations in diversion programs. Clearly, the CCC is committed to purchase unlimited stocks of feed grains at the loan rate. This commitment has varied. It was made to all producers from 1948 to 1955 and from 1959 to 1960, to compliers and noncompliers at differential rates from 1956 to 1958, and to compliers only from 1961 to the present.[16] The high proportion of feed grain production under governmental programs has made the CCC a potentially powerful market influence during the postwar period. The CCC's demand for corn can be characterized as perfectly elastic at the loan rate which sets an effective floor on market price. Similarly, the CCC stocks of feed grains so acquired are generally made available for sale in the market at or above the statutory 105 percent of loan

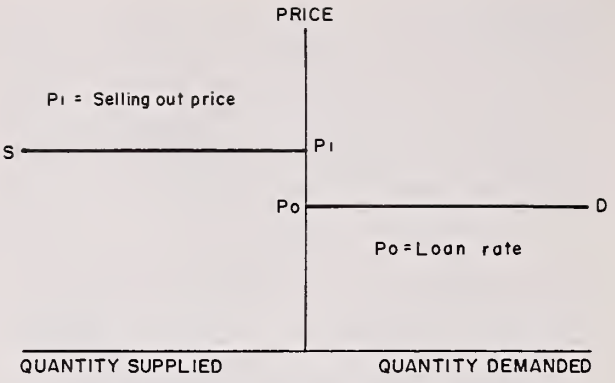

Figure 4.--CCC Operations in feed grains.

rate.[17] These stocks to the limit of their availability, hanging over the market, by their very existence have a moderating influence on price and, when sold, a direct effect on feed grain prices. It is argued, then, that the CCC is a perfectly elastic (to the limit of stocks) supplier of corn at the policy-determined selling-out price. The nature of the CCC in the market is shown in figure 4. If the market-determined price falls within the price range $P_1 - P_0$, the CCC does not enter the market; at P_0 it buys and at P_1 it sells. Thus, it is argued, the CCC acts as a buffer stock agency in the United States and world feed grain markets. Its operations are analogous to the operation of the International Tin Agreement.[18]

The model, as a conceptualization of the world feed grain market, is complete. Net exportable surpluses and deficits, as determined by market and policy factors, are projected into the U.S.

[16] Feed Situation, U.S. Dept. Agr., ERS, Nov. 1965, p. 41.

[17] See M. R. Benedict and O. C. Stine, The Agricultural Commodity Programs (New York: The Twentieth Century Fund, 1956), p. 221. As of December 23, 1966, the resale price has been 115 percent of the loan rate plus charges except for sales under the Emergency Livestock Feed Program, sales of out-of-condition grain, and sales for export. However, it is likely that given present low stock levels, the CCC will apply the restriction across the board. (See U.S. Dept. Agr., Feed Situation, ERS, Feb. 1967.)

[18] See United Nations Conference on Trade and Development, Geneva, March 23 to June 16, 1964, Proceedings, Vol. III: "Commodity Trade" (New York: United Nations, 1964), pp. 92-93, 104-110. Also see L. Baranyai and J. C. Mills, International Commodity Agreements (Mexico: Centro de Estudios Monetarios Latinoamericanos, 1963), pp. 128-147.

feed grain market where domestic and world price is discovered and, to a large degree, determined. If price so determined falls between the price range bounded by the U.S. loan rate and the selling-out price, the CCC is not active in the market. If price should move outside this range, the CCC acts by purchase or sale to move price back into the range. Thus, world price is stabilized by U.S. action between U.S. policy parameters. The world picture is presented in figure 5, which combines the essential elements of the model. $S_{us} - S_{us}$ and $D_{us} - D_{us}$ are U.S. domestic supply and demand functions. $S_w - S_w$ is the world supply function derived by adding net export supply from other exporters to U.S. supply. It becomes horizontal at P_0, which is the CCC selling-out price. Similarly, $D_w - D_w$ is a world demand function which becomes perfectly elastic at P_1, the U.S. loan rate. As $S_w - S_w$ and $D_w - D_w$ are drawn, price P_2 is established without CCC action. If, however, world demand was $D^2_w - D^2_w$, price would be at P_0 rather than P_3 as CCC stocks were sold into the market. If world supply were $S^2_w - S^2_w$, price would be P_1 rather than P_4, as the CCC took possession of stocks placed under support programs. World price is determined in the U.S. market, and it is in turn influenced by domestic price support operations. The important policy parameters are, therefore, the U.S. loan rate, the selling-out price for feed grain stocks, and the acreage diversion requirements for feed grain programs.

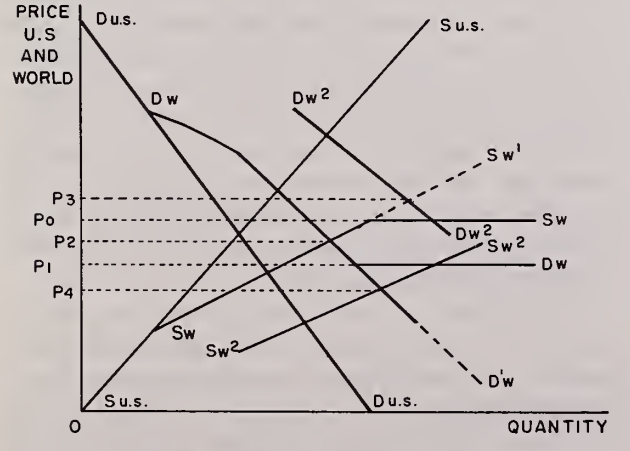

Figure 5.--The feed grain model.

The Model and the Postwar Grain Market

In an attempt to relate the model to postwar conditions, the structural assumptions and the major behavioral assumption about the role of the CCC will be discussed in the context of U.S. feed grain policy. The assumption of the competitive nature of the U.S. feed grain market rests on two basic facts. First, the total volume of trade in the market is performed by private traders in sufficient numbers to make the market competitive. Second, the large proportion of production which either is not marketed or is involved in interfarm transactions depends on the decisions of many small (in relation to the total market) farm units. The potential market power of the CCC follows directly from the substantial stocks, sometimes as much as one-third of production, that the CCC holds as a result of support activities.[19] Despite the fact that in 1966-67 stocks have fallen substantially (to about 118 million bushels of corn as of January 1, 1967), the productive potential held in abeyance by Government programs will continue to cause policy decisions by the U.S. Department of Agriculture to have profound influences on U.S. and world market conditions.

The second structural assumption, namely that the U.S. feed grain market is the price-setting market, rests primarily on the fact that the United States produces between 45 and 50 percent (more than 60 percent of corn production) of world feed grain production and exports more than 50 percent (55 percent of corn) of the feed grains entering international channels.[20] This production and trade dominance, the relatively high degree of integration between the domestic and international market, and the role of the CCC as market participant argues strongly for the proposition that world price is discovered and, to a large degree, determined

[19] See U.S. Dept. Agr., Agricultural Statistics, 1965, table 49, p. 37, for CCC stocks of corn as of September 30 for 1954-62 (highest volume 1,371 billion bushels in 1960), and U.S. Dept. Agr., Feed Situation, ERS, June 1966, p. 30, for 1963-66.

[20] See FAO, The Stabilization of World Trade . . ., table 1, p. 2, and table 8, p. 23.

by conditions in the U.S. market. The integration follows from the fact that the United States places few import restrictions on feed grain imports and, since 1961, has not paid export subsidies on feed grains.[21] Further, the existence of large and continuous stocks has placed the United States in a strong position in a world market which in the prewar and immediate postwar period was characterized by highly variable export availability from other suppliers.

The major element of the above model which needs careful consideration is the first behavioral assumption regarding the CCC. (Behavioral assumptions 2, 3, and 4 are widely held assumptions common to economic analysis and are not discussed.) The nature of CCC operations has been, is, and will continue to be dictated by the nature of domestic feed grain policy. It will be worthwhile, then, to review the nature of feed grain support since 1948.

From the beginning of the war until 1948, average prices received by farmers were continuously above the average support prices, resulting in little Government activity in the feed grain market. The year 1947 was a transitional year as national average corn price support rose from $1.15 to $1.37 per bushel, but average price received by farmers rose from $1.53 to $2.16 per bushel. The result was that 1 percent of production was placed under price support. In 1948, price support rose to $1.44 per bushel, while average price received fell to $1.28 per bushel as postwar shortages were rapidly overcome by rising production in North America and Western Europe. The result was the beginning of heavy Government purchases of corn and feed grains. With the exception of 1950 and 1951 (the first 2 years of the Korean conflict), the loan, acquisition, and stock activities of the CCC have been important factors in the U.S. market. From 1948 to 1954, price supports on corn were available to all producers, and CCC stocks of corn rose from almost zero to 622 million bushels. In 1954, acreage allotments were resumed, and in 1956 the Soil Bank Program which resulted in a differentiation in support rates was made between compliers and noncompliers, but the compliers' support rate remained high ($1.50 in 1956, $1.40 in 1957, and $1.36 in 1958). The loan rate was dropped to $1.12 per bushel in 1959 and to $1.06 per bushel in 1960, but loans were available to all producers. Despite the lowering of support rates and the constant decline in market prices, production and CCC stocks continued to rise, with stocks standing at 1.37 billion bushels of corn on September 30, 1960.

From 1948 through 1960, exports of feed grains more than doubled, but, because of the high level of price support in relation to world prices, export subsidies were paid on corn and sporadically on other feed grains from 1954 to 1961. The Emergency Feed Grain Program of 1961 raised the loan rate to $1.20 per bushel. But loans were available only to compliers, who were paid "in kind" to reduce their acreage 20 percent or 40 percent. The program also allowed the CCC to redeem "payments in kind" certificates in cash, at prices which were in fact below 105 percent of the loan rate. It seems clear that the movement of stocks under this provision was an important factor in maintaining market prices substantially below the loan rate, making compliance attractive.

In 1963, the feed grain program in its present form came into being when loan rates were lowered and participants were given a support payment directly. With implementation of the 1961 program, export subsidies on feed grains

[21] It is true, however, that the United States has sold some quantities of feed grains under P.L. 480 programs. These disposals have had a price-buoying effect in the sense that they have lessened price-depressing CCC stocks. However, the magnitude of these sales relative to commercial exports has never been large, thus, their price implications have likely been small. For quantification of the last 3 years, see Eleanor N. DeBlois, "High Level Dollar Exports Boost Total Exports of U.S. Farm Products for Second Consecutive Fiscal Year," U.S. Dept. Agr., ERS-Foreign 150, Jan. 1966, pp. 15, 25, and 26; and Eleanor N. DeBlois, "Increased Dollar Exports in Fiscal Year 1965-66 Bring U.S. Exports of Farm Products to Record Level for Third Consecutive Year," U.S. Dept. Agr., ERS-Foreign 177, Nov. 1966, pp. 24, 38, and 39.

ceased, and the U.S. market price was the availability price to world buyers.[22]

The important elements of the above review are: (1) During the 1950's the determination of the export subsidy on corn by the United States had a direct influence on world price; (2) from 1961 to the present, the loan rate and the disposition of stocks by the United States influenced domestic and, therefore, international corn prices; and (3) on the basis of this analysis, it seems clear that it has been domestic considerations--for example, the need for compliance in 1961-62 and the fear of inflation in early 1966--which have dictated large-scale disposal of U.S. feed grain stocks to stabilize price. Thus, it is held that U.S. domestic agricultural policy heavily influences world feed grain prices and that the major behavioral assumption is consistent with past and present policies.

Two further qualifications must, however, be mentioned. First, sorghum grain exports have continued to receive export assistance in the form of subsidy payments.[23] This result is not completely consistent with the model, but it may be that the substitution between wheat and sorghum grain in the Plains areas means that wheat prices influence sorghum prices more than other feed grain prices. Second, and more important, the statutory selling-out price specified for the CCC has not generally applied to export sales. This is coupled with the fact that in years when compliers have been treated differently from noncompliers, the noncomplier's influence has been sufficient to maintain market prices below the loan rate. This was especially true in the late 1950's and early 1960's. These two factors do not invalidate the major premise of the argument, namely, that U.S. domestic policy considerations heavily influence world feed grain prices. They do, however, tend to suggest that the model's price limits, the loan rate and the selling-out price, will not always embrace U.S. and world market prices.

It remains now to discuss the implications of the model in relation to the world feed grain market. The residual nature of the international market, where quantities supplied and demanded vary with domestic supply and policy conditions, would suggest that volumes entering the market would demonstrate substantial year-to-year variation. Figure 6 shows the variability of South African, and especially Argentine, exports. The date also reveal that yearly falls in exports from one country are often offset by increases in exports from other countries. Also, the relatively lower degree of variability in year-to-year shipments by the United States from 1949 to 1965 lent a degree of stability to total world exports. The rapid rise in corn exports since 1955 is clearly shown.

Further insights are gained when total production is compared with exports. U.S. corn production increased rapidly from 1954 to a peak in 1959, then declined until 1962. Since

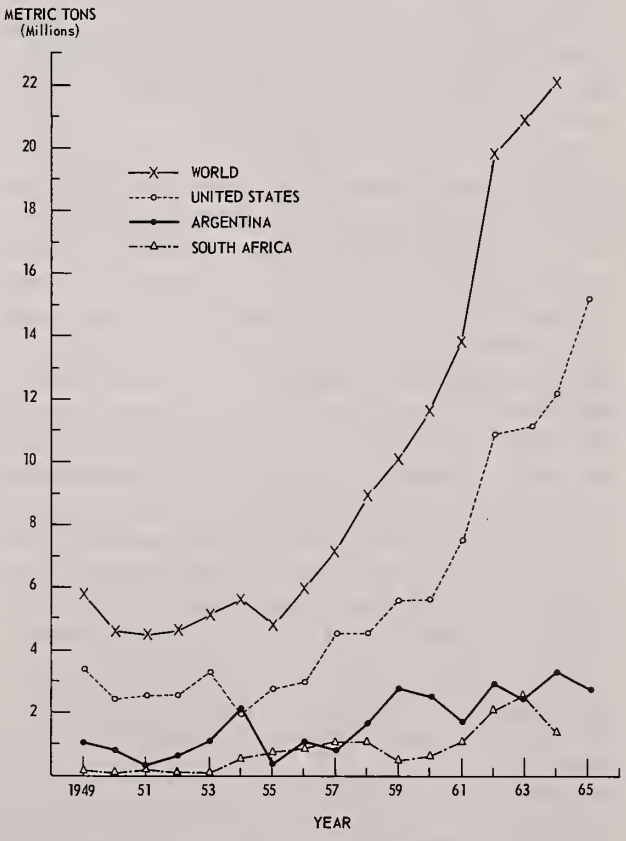

Figure 6.--Corn exports, 1949-65.

[22] This brief review of feed grain policy is drawn from several sources: Benedict and Stine, op. cit., pp. 215-232; U.S. Dept. Agr., Feed Situation, ERS, Nov. 1965, p. 41; U.S. Dept. Agr., Grain and Feed Statistics Through 1961, ERS, Statis. Bul. 159, June 1962, tables 40, 45, and 46; and U.S. Dept. Agr., Feed Situation, ERS, Feb. 1960, p. 16.

[23] U.S. Dept. Agr., Foreign Agricultural Trade of the United States, ERS, June 1966, p. 14.

then, moderate increases as a result of yield increases have occurred. This is quite a different pattern from the one exports have demonstrated. When production is correlated with export volumes from 1949 to 1963, a correlation coefficient of 0.2 results, suggesting little relationship. On the other hand, when Argentine export volumes are correlated with domestic production from 1955 to 1963, a correlation coefficient of 0.82 results, indicating that variations in Argentine exports are closely related to variations in domestic production. Both of these results are consistent with the behavior suggested by the above model.

A second major implication of the model is that if the United States has operated as a buffer stock agency for the world feed grain market while other countries have marketed total yearly supplies, the United States would be the major stockholder. From 1954 to 1963, the United States consistently held between 90 and 95 percent of world corn stocks, between 50 and 60 percent of oats stocks, about 50 percent of barley stocks, and 80 to 90 percent of sorghum stocks. The other major holder of barley and oats stocks has been Canada. Other exporters in the postwar period have held virtually no stocks.[24] This relation again is consistent with postulated behavior.

Finally, to the extent that U.S. domestic farm programs have stabilized prices domestically, this price stability should be projected into the world market. The FAO study[25] plots yearly average prices of all grains from 1925 through 1938 and 1950 through 1961. If variations in postwar freight rates are taken into consideration, variations in postwar prices have been substantially less than in the prewar period. The study attributes this increased stability to two major factors: (1) "The stockholding policies of the United States" which, in a period of excess supply in the international market, have provided known supplies of feed grains, thus mitigating price fluctuations, and (2) the geographical diversity of feed grain production, which means that shortages in some parts of the world are generally offset by surpluses in others. Further, the increasing substitutability among various feed grains in consumption provides a stabilizing function.[26] These results also are consistent with the outcomes suggested by the model.

[24] See U.S. Dept. Agr., Agricultural Statistics, 1964, table 69, p. 51.

[25] See FAO, The Stabilization of World Trade . . ., charts 7 and 8.

Summary and Conclusions

The model of feed-grain pricing presented above gives the United States a dominant or near-monopoly power position in the world feed grain market. Domestic policy parameters, the loan rate, acreage diversion provisions, and the CCC selling-out price are projected into the world market, with the result that CCC operations have direct impacts on world prices. This conceptualization of the world market should be useful to policymakers because it identifies two major elements which must be considered in international discussions.

1. The feed grain policy of the United States has had and will continue to have a profound influence on world markets. While it is true that the present stock position of the United States does not permit large short-term stock disbursements for the purpose of price stabilization, the longer-term impact of alterations in programs to allow larger acreages gives the United States long-term market power. Only in the event that total land utilization is permitted will the direct influences of U.S. policy be eliminated. But even in this event, the U.S. market will still be dominant in setting world feed grain prices.

2. As long as world price remains below the support levels in the major importing markets, namely the EEC and the United Kingdom, domestic objectives rather than international conditions will influence the import demand for feed grains. Expressed differently, international price movements have relatively little effect on the quantities produced and consumed in most importing countries.

[26] FAO, Ibid., pp. V, 28, 37-41.

Use of Marginal R^2 and Partial r^2 in a Multiple Regression Analysis

By Harry H. Harp

USE OF MULTIPLE REGRESSION techniques has been facilitated by the development of electronic computers and prewritten programs which make it possible to solve complex regression equations in minutes and at a greatly reduced cost. One of the problems remaining in the use of multiple regression is to find ways to present results in a way that is meaningful to the nonstatistician, as well as to those initiated in the use of statistical terms.

Presentation of the results of a multiple regression analysis is frequently more meaningful when the contribution of each independent variable in explaining the total R^2 is shown. This article reviews two techniques for calculating and presenting the contribution of each independent variable. Technique 1 is based upon the standardized regression coefficients (b*) adjusted for intercorrelation. Technique 2 is based upon the separate effect of individual variables. It is measured by observing the increment in explained variance when each variable is added after all other variables under consideration are entered and held constant.

Because of ease of computation, technique 1 has sometimes been used; but it is doubtful whether much confidence can be placed in it. Technique 2 has several advantages over technique 1. It is simpler to present in tabular form and it does not show negative contribution for variables when they actually contribute to explaining total variance. However, neither of the two techniques presented provides an unambiguous measure of the contribution of individual variables when interaction exists between the independent variables.

To illustrate the use of these techniques, data were taken from an analysis of the relationship between sales volume and factors influencing demand for 110 convenience foods.[1] The estimating equation derived from these data is as follows:

$$\begin{aligned}(1)\ \text{Log } \hat{Y} = &- .60 - .60\,(\log X_1)^2 - .85 \log X_2 \\ &+ .28\,(\log X_3)^2 + .31 \log X_4 \\ &+ .65 \log X_5 - .16\,(\log X_5)^2 \\ &+ .44 \log X_6 + .23 \log X_7 \\ &- .58 \log X_8 + .33 \log X_9,\end{aligned}$$

where the specific quantitative measures developed are as follows:

Sales:

$\hat{Y}$ = Estimated national sales of convenience foods in supermarkets in terms of 100 million servings sold annually.

Cost per serving:

X_1 = Cents per serving of convenience food.

Degree of competition:

X_2 = Sales of all other convenience items in same product group as percent of product group.

X_3 = Cents per serving of fresh or home-prepared foods.

X_4 = Cents per serving of highest volume competing convenience item in product group.

[1] Harry H. Harp and Marshall E. Miller, Convenience Foods: The Relationship Between Sales Volume and Factors Influencing Demand, U.S. Dept. Agr., Agr. Econ. Rpt. 81, Oct. 1965.

Importance in purchase pattern:

X_5 = National sales of all items in product group in supermarkets in terms of 100 million servings sold annually.

Availability:

X_6 = Percent availability of convenience items in terms of the percent of times observed by price enumerators in a sample of supermarkets in four metropolitan areas during a 12-month period of observation.

Success of similar convenience products:

X_7 = Sales of highest volume competing convenience item in same product group (100 million servings sold annually in supermarkets).

Special-product groups:

X_8 = Specialty products, i.e., foreign specialty products (1 if a specialty product, 0 if not).

X_9 = Ready-to-serve baked products (1 if a specialty product, 0 if not).

Other terms used in this paper include the following:

1. Simple r, the correlation between two variables with no restrictions on variables other than the two in question.

2. Partial r, one independent variable is correlated with the dependent variable and all other independent variables in the equation are statistically held constant at their mean.

3. Multiple R^2, the ratio of the variance explained by the regression equation to total variance.

4. R^2 delete, the multiple R^2 which would be obtained if a variable were deleted from the equation and the equation was recalculated.

5. Marginal R^2, the ratio of the increment in explained sum of squares contributed by an individual variable to the total sums of squares (or the multiple R^2 minus the R^2 delete) when the variable is added after all others under consideration are entered and statistically held constant at their mean.

6. Standardized coefficients (b*), the b values transposed to standard units by multiplying the b values by the ratio of the standard deviation of the dependent and independent variable, $b^* = b\,(s_x/s_y)$.

Most of the terms and equations in this paper are known by statisticians and are often included in introductory textbooks on statistics. However, the term "marginal R^2" and the equations for computing this statistic are thought to be new.[2]

Technique 1

Technique 1 is based on standardized regression coefficients (b*) adjusted for intercorrelation. The sum of these adjusted coefficients is equal to the multiple R^2. The direct and indirect effects of each independent variable on the multiple R^2 are computed from standardized coefficients (b*'s) and simple r values.[3] Equation (2) shows that the direct effects of independent variables are the sum of the b^{*2} values, and the indirect effects are the sum of the products of 2 times the b* values and the simple r's. If the independent variables have no intercorrelation among them, the indirect effects will be zero and the sum of the b^{*2} values will equal the multiple R^2. The equations for computing direct and indirect effects are illustrated with the market performance data previously identified.

$$
\begin{aligned}
(2)\ \text{Multiple } R^2 &= \text{direct effects} + \text{indirect effects} \\
&= (b_1^{*2} + b_2^{*2} + b_3^{*2} + b_4^{*2} + b_5^{*2} \\
&\quad + b_{5^2}^{*2} + b_6^{*2} + b_7^{*2} + b_8^{*2} + b_9^{*2}) \\
&\quad + (2b_1^* b_2 r_{12}) + (2b_1 b_3 r_{13}) \\
&\quad + (2b_1 b_4 r_{14}) + (2b_1^* b_5^* r_{15}) \\
&\quad + (2b_1^* b_{5^2}^* r_{15^2}) + (2b_1^* b_6^* r_{16}) \\
&\quad + (2b_1^* b_7^* r_{17}) + (2b_1^* b_8^* r_{18}) \\
&\quad + (2b_1^* b_9^* r_{19}) + (2b_2^* b_3^* r_{23}) \\
&\quad + (2b_2^* b_4^* r_{24}) + (2b_2^* b_5^* r_{25}) \ldots \\
&\quad + (2b_8^* b_9^* r_{89})
\end{aligned}
$$

[2] Equation (10), p. 109.

[3] Robert Ferber, Statistical Techniques in Marketing Research, McGraw-Hill, New York, 1st ed., Apr. 1949, p. 364.

Table 1 shows net effects as the difference between the direct and the indirect effects. Equation (3) may be used as a check of the net effect presented in table 1.

When a variable is added to the regression, all standardized coefficients (b*) are likely to change and true net effect of such an addition will be positive. However, difficulties have been encountered in using table 1 to show the direct, indirect, and net effect of variables in a regression equation. When there is a great deal of interaction between the independent variables, the so-called net effect shown in table 1 might appear to be negative if one were to forget that the direct, indirect, and net effects are integral parts of the sums and consider only a portion of these sums. The net effects for independent variables in a multiple regression analysis will appear to be negative when the signs of the b* and corresponding simple r are not the same (equation 3).

$$
\begin{aligned}
(3)\ R^2 = {} & \text{net effect } X_1 + \text{net effect } X_2 \\
& + \text{net effect } X_3 + \text{net effect } X_4 \\
& + \text{net effect } X_5 + \text{net effect } X_5^2 \\
& + \text{net effect } X_6 + \text{net effect } X_7 \\
& + \text{net effect } X_8 + \text{net effect } X_9 \\
= {} & b_1^* r_{y1} + b_2^* r_{y2} + b_3^* r_{y3} + b_4^* r_{y4} \\
& + b_5^* r_{y5} + b_{5^2}^* r_{y5^2} + b_6^* r_{y6} + b_7^* r_{y7} \\
& + b_8^* r_{y8} + b_9^* r_{y9}
\end{aligned}
$$

In a multiple regression analysis the coefficients (b values) usually have the same sign as the simple r with the dependent variable. However, when two or more of the independent variables are highly correlated, the signs of the b values of the dependent variables may not agree with the signs for the corresponding simple r values.[4] This results because the weaker independent variables modify the effect of the stronger independent variable on the dependent variable. For instance, even though all of the variables in equation (1) made a statistically significant contribution to explaining variance in sales of convenience foods, three of the variables, X_2, X_3, and X_5^2, appear to have negative net effects in table 1. This is due to the intercorrelation among the independent variables.

When a negative sign is obtained for a net effect, it does not mean that the variable adds less than nothing to the reduction of unexplained variance or is of no significance. It means that the influence of the variable is working counter to the influence of other variables to reduce the bias in the final estimate. Thus, it may prevent some of the predicted values from going as low as they otherwise would when the effect of one or more of the other variables is downward, and it may tend to keep predicted values from going as high as they otherwise would when the other variables are forcing predicted values up.

Technique 1 is quite similar to the technique of separate determination which is described by Ezekiel.[5] The coefficient of separate determination is identical to the so-called net effect. The main difference between separate determination and technique 1 is that technique 1 attempts to allocate the influence of each variable into direct and indirect effects; whereas separate determination does not distinguish between the direct and indirect effects.

In an economic analysis, there is generally considerable interaction between some of the independent variables.[6] When such interaction exists, technique 1 will provide answers which lack clarity and are difficult to present in a nontechnical tabular form. Therefore, other measures of the individual importance of the independent variable--for example, technique 2--may be preferred.

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[4] Karl A. Fox and James F. Cooney, Jr., Effects of Intercorrelation Upon Multiple Correlation and Regression Measures, U.S. Dept. Agr., AMS-341, 28 pp., 1954.

[5] Mordecai Ezekiel, Methods of Correlation Analysis, John Wiley and Sons, New York, 2d ed., 1941, p. 498.

[6] James N. Morgan and John A. Sonquist, "Problems in the Analysis of Survey Data and a Proposal," Jour. Amer. Statis. Assoc., Vol. 58, June 1963, pp. 415-435. Donald E. Farror and Robert R. Glauber, "Multicollinearity in Regression Analysis: The Problem Revisited." Rev. Econ. and Statis., Vol. XLIX, No. 1, Feb. 1967, pp. 92-107.

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Table 1.--Direct and indirect effects of the factors influencing sales of convenience foods

Effect	Cost per serving X_1	Convenience items as percent of product group X_2	Cost of home-prepared foods X_3	Cost of competing convenience foods X_4	Sales of product group X_5	Squared value of product group X_5^2	Availability of convenience foods X_6	Sales of competing products X_7	Specialty products X_8	Ready-to-serve baked products X_9	Total
Direct.....	.387	1.019	.069	.408	.340	.075	.017	.188	.054	.026	2.583
Indirect:											
X_1 and X_2	-.025	-.025									-.050
X_1 and X_3	-.141		-.141								-.282
X_1 and X_4	-.054			-.054							-.108
X_1 and X_5	.186				.186						.372
X_1 and X_5^2	-.062					-.062					-.124
X_1 and X_6	.018						.018				.036
X_1 and X_7	.043							.043			.086
X_1 and X_8	.068								.068		.136
X_1 and X_9	.009									.009	.018
X_2 and X_3		.019	.019								.038
X_2 and X_4		-.557		-.557							-1.114
X_2 and X_5		-.127			-.127						-.254
X_2 and X_5^2		.020				.020					.040
X_2 and X_6		.027					.027				.054
X_2 and X_7		-.398						-.398			-.796
X_2 and X_8		.012							.012		.024
X_2 and X_9		-.033								-.033	-.066
X_3 and X_4			.029	.029							.058
X_3 and X_5			-.077		-.077						-.154
X_3 and X_5^2			.023			.023					.046
X_3 and X_6			-.006				-.006				-.012
X_3 and X_7			-.019					-.019			-.038
X_3 and X_8			-.032						-.032		-.064
X_3 and X_9			-.009							-.009	-.018

X_4 and X_5				.058	.058						.116
X_4 and X_5^2				-.006		-.006					-.012
X_4 and X_6				-.010			-.010				-.020
X_4 and X_7				.230				.230			.460
X_4 and X_8				-.040					-.040		-.080
X_4 and X_9				.014						.014	.028
X_5 and X_5^2					-.137	-.137					-.274
X_5 and X_6					.009		.009				.018
X_5 and X_7					.117			.117			.234
X_5 and X_8					.031				.031		.062
X_5 and X_9					.009					.009	.018
X_5^2 and X_6						-.005	-.005				-.010
X_5^2 and X_7						-.043		-.043			-.086
X_5^2 and X_8						-.012			-.012		-.024
X_5^2 and X_9						-.001				-.001	-.002
X_6 and X_7							-.009	-.009			-.018
X_6 and X_8							.005		.005		.010
X_6 and X_9							-.003			-.003	-.006
X_7 and X_8								.004	.004		.008
X_7 and X_9								.014		.014	.028
X_8 and X_9									.003	.003	.006
Total indirect..	.042	-1.062	-.213	-.336	.069	-.223	.026	-.061	.039	.003	-1.716
Net.....	.429	-.043	-1.44	+072	.409	-.148	.043	.127	.093	.029	.867

Technique 2

Technique 2 provides a measure of the additional variance explained when the variable is added to the regression equation after all of the other independent variables have been entered into the equation. Conceptually, the additional contribution of each independent variable after all others are included in the equation appears to be one of the most useful methods of presenting the importance of each variable in a regression equation. One such measure is the partial r^2 which shows the percentage each variable reduces the total unexplained variance after all other variables under consideration were previously entered and held constant.

Ezekiel and Fox have demonstrated that the partial r values are a measure of the separate effects of individual variables.[7] Equation (4) has been used to show this relationship. This technique corresponds to the last step in the stepwise regression:

$$(4)\quad r^2_{12.34} = 1 - \frac{1 - R^2_{1.234}}{1 - R^2_{1.34}}$$

$$r^2_{13.24} = 1 - \frac{1 - R^2_{1.234}}{1 - R^2_{1.24}}$$

$$r^2_{14.23} = 1 - \frac{1 - R^2_{1.234}}{1 - R^2_{1.23}}$$

Kenneth J. McCallister, Marketing Economics Division, ERS, shows the partial r^2 may be expressed as a function of the F value[8] for that particular variable and degrees of freedom involved. This significant equation is as follows:

$$(5)\quad \text{Partial } r^2 = \frac{1}{1 + \frac{\text{degrees of freedom}}{F}}$$

[7] Mordecai Ezekiel and Karl A. Fox, Methods of Correlation and Regression Analysis, John Wiley and Sons, New York, 3d ed., 1965, p. 192.

[8] $F = b^2/Sb^2$.

Equation (6), the extension of McCallister's equation for partial r^2, shows its relationship to Waugh's[9] equation for partial r. To simplify the notation, the partial regression coefficient is designated b, its standard error as Sb, degrees of freedom as d.f.

$$(6)\quad \text{Partial } r^2 = \frac{1}{1 + \frac{d.f.}{F}}$$

$$= \frac{F}{F + d.f.}$$

$$= \frac{\frac{b^2}{Sb^2}}{\frac{b^2}{Sb^2} + d.f.}$$

$$= \frac{b^2}{b^2 + (d.f.)(Sb^2)}$$

$$\text{Partial } r = \frac{b}{\sqrt{b^2 + (d.f.)(Sb^2)}}$$

Although partial r's and F values with fixed degrees of freedom are quite similar, some statisticians are accustomed to analyzing data and thinking in terms of one or the other. Thus, it may be desirable to present both partial r^2 and the F values or t values.[10]

From the partial r^2 and the multiple R^2, the R^2 delete may be computed. As previously defined, the R^2 delete is the multiple R^2 which would be obtained if a variable were deleted from the equation and the equation recalculated. The R^2 delete for each variable may be computed from the partial r^2 and the multiple R^2 as in the following equation:[11]

$$(7)\quad R^2 \text{ delete} = \frac{\text{multiple } R^2 - \text{partial } r^2}{1 - \text{partial } r^2}$$

[9] Frederick V. Waugh, "The Computation of Partial Correlation Coefficients," Jour. Amer. Statis. Assoc., Vol. 41, No. 236, Dec. 1946, pp. 543-546.

[10] The square of the 2-tailed t value at a given probability level is equal to the single-tailed F value.

[11] Mich. State Univ. Agr. Expt. Sta., Calculation of Least Squares (Regression) Problems on the LS Routine, STAT Ser. Descr. 7, Dec. 1966, p. 38.

The difference between the multiple R^2 and R^2 delete is the marginal R^2 for the deleted variable. The formula for computing the marginal R^2 is:

(8) Marginal R^2 = Multiple R^2 - R^2 delete

An alternate equation is:

$$(9)\ \text{Marginal } R^2 = F\ \frac{\text{Residual mean square}}{\text{Total sum of squares}}$$

This reduces to:

$$(10)\ \text{Marginal } R^2 = \frac{\text{Reduction in sum of squares}}{\text{Total sum of squares}}$$

The marginal R^2 values in tables 2 and 3 measure the increment in explained variance when each variable is added after all others under consideration are entered and statistically held constant at their mean.

Because the marginal R^2 values are all expressed as a ratio to the same base--i.e., the total sum of squares--they are directly comparable to each other and are additive. This permits summing individual marginal R^2 and subtracting from the total multiple R^2 to give a measure of the joint effects. This is shown in table 3.

(11) Joint effects = R^2 - sum of marginal R^2 values

In conclusion, the additional contribution of each variable in explaining total variance after all others are included in the equation appears to offer the least complex method of presenting the influence of each variable.

Table 2.--Relative importance of individual variables affecting sales of convenience foods

$R_{y123455^2 6789}$	Variable deleted	Variables in equation	R^2 delete	Marginal R^2 [1]
(1)	(2)	(3)	(4)	(5)
.87	X_2	$X_1, X_3, X_4, X_5, X_5^2, X_6, X_7, X_8, X_9$	.78	.09
.87	X_1	$X_2, X_3, X_4, X_5, X_5^2, X_6, X_7, X_8, X_9$	.78	.09
.87	X_5	$X_1, X_2, X_3, X_4, X_5^2, X_6, X_7, X_8, X_9$	.81	.06
.87	X_4	$X_1, X_2, X_3, X_5, X_5^2, X_6, X_7, X_8, X_9$	.82	.05
.87	X_8	$X_1, X_2, X_3, X_4, X_5, X_5^2, X_6, X_7, X_9$	.84	.03
.87	X_9	$X_1, X_2, X_3, X_4, X_5, X_5^2, X_6, X_7, X_8$	.85	.02
.87	X_5^2	$X_1, X_2, X_3, X_4, X_5, X_6, X_7, X_8, X_9$	.86	.01
.87	X_6	$X_1, X_2, X_3, X_4, X_5, X_5^2, X_7, X_8, X_9$	.86	.01
.87	X_3	$X_1, X_2, X_4, X_5, X_5^2, X_6, X_7, X_8, X_9$	.86	.01
.87	X_7	$X_1, X_2, X_3, X_4, X_5, X_5^2, X_6, X_8, X_9$	.86	.01

[1] Col. 5 = Col. 1 - Col. 4.

Table 3.--Contribution of each variable to explaining variance in sales of convenience foods

Source of variation	Sum of squares	F Value	Partial r^2 (1)	Marginal R^2
Independent effects:				
Convenience items as a percent of product group, X_2	3.76	66.79	.40	.090
Cost per serving, X_1	3.70	65.68	.40	.088
Product group, X_5	2.49	44.18	.31	.060
Cost of competing convenience items, X_4	2.13	37.92	.28	.051
Specialty products, X_8	1.34	23.78	.19	.032
Ready-to-serve baked products, X_9	.93	16.53	.14	.022
Square value of product group, X_5^2	.57	10.09	.09	.013
Availability, X_6	.55	9.79	.09	.013
Cost of home-prepared foods, X_3	.53	9.50	.09	.013
Sales of competing products, X_7	.50	8.82	.09	.012
Total independent effects	16.50			.394
Joint effects	19.78			.473
Total effects explained	36.28			.867
Residual variance	5.57			.133
Total	41.85			1.00

[1] With 99 degrees of freedom.

Nonequilibrium Fixed-Price Schemes in Agricultural Trade[1]

By Alex F. McCalla and Elmer W. Learn

THE KENNEDY ROUND negotiations of the General Agreement on Tariffs and Trade (GATT) occasioned the public presentation of a number of proposals for "organizing agricultural trade." The proposals of the European Economic Community (EEC) had as their central characteristics the fixing of a world price, though not an equilibrium price, consistent with domestic agricultural objectives and the disposing of excess supplies in developing nations. These proposals, known at various stages in their evolution as the Pisani-Baumgartner plan, Mansholt I, and Mansholt II, can be characterized as nonequilibrium fixed-price schemes.

This paper analyzes the implications of such a scheme for various types of exporters and importers in the world market. First, for purposes of comparison, an equilibrium pricing model is presented for the one-commodity, two-country model. Second, the characteristics of the Pisani-Baumgartner type of plan are outlined. The plan is then subjected to simple graphic analysis which demonstrates the nature of gains and losses resulting from its operations. Finally, some general conclusions are drawn about the implications of fixed-price schemes.

The Equilibrium Trade Model

The central characteristic of the traditional trade model is that price is flexible with the result that the international market is always cleared.

Assume as a beginning point that the world consists of two countries and one commodity.[2] In figure 1, panel A shows country A's supply and demand functions in a regular fashion and panel B shows country B's as a mirror image of panel A. With no trade, country A's supply is Sa-Sa, A's demand is Da-Da, and price is Pa. In country B, supply is Sb-Sb, demand is Db-Db, and price is Pb. Now permit trade and assume no transport or entry costs. World supply, Sw, and world demand, Dw, are derived by the horizontal addition of country A's and country B's demand and supply functions. Equilibrium world price is therefore Pw. In country A at Pw, Q2 is produced, Q1 is consumed, and Q2 - Q1 is exported. In country B, Q4 is consumed, Q3 is produced, and Q4 - Q3 is imported and by construction is equal to Q2 - Q1. Thus, Da+e becomes the effective demand in country A. It is derived by netting supply and demand in B and adding it to Da-Da. Effective supply, Sb+i, is determined in country B in an analogous fashion. Now if transport or other costs are introduced, effective demand in country A is shifted downwards to D'a+e, price Pa' prevails, and effective supply in country B is shifted upwards to S'b+i with price Pb' prevailing. The difference between Pa' and Pb' is the cost of transport or cost of trade as labeled in figure 1.[3] Of course, if the difference between the initial no-trade prices Pa and Pb were less than the cost of trade, i.e., the difference between Pa' and Pb', then no trade would occur.[4] Portrayed here as a shift in the effective demand and supply functions, the effect of a transport cost is identically the same as that of the application of a fixed

[1] Minn. Agr. Expt. Sta. Sci. Jour. No. 6332. Research upon which this article is based was supported by the University of Minnesota and by a grant from the Economic Research Service, U.S. Department of Agriculture.

[2] The analysis portrayed in figure 1 is derived in part from P. T. Ellsworth, The International Economy (New York: The Macmillan Co., 1958), pp. 110-111.

[3] The allocation of the "cost of trade" equally to country A and country B is arbitrary. It is the magnitude of the "cost of trade" which is important to the analysis.

[4] See P. A. Samuelson, "Spatial Price Equilibrium and Linear Programming," Amer. Econ. Rev., Vol. XLII, No. 3, June 1952, pp. 283-303.

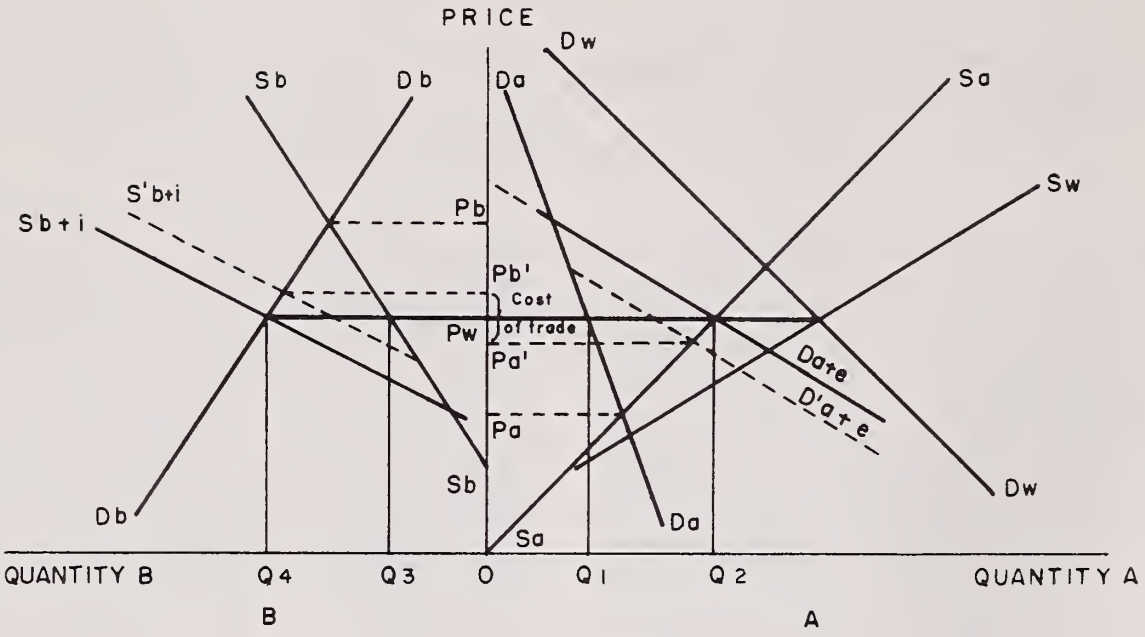

Figure 1

tariff.[5] Samuelson[6] has shown how such a model involving the spatial separation of markets and differing transport costs can be generalized for m exporters and m+1 to n importers. However, the two-country model is sufficient to demonstrate the central element of the classical trade model, namely, that equilibrium is characterized by a set of market-clearing prices and quantities.

The Nonequilibrium Fixed-Price Scheme

Over a 3-year period, the French government put forward through Messieurs Pisani (Minister of Agriculture) and Baumgartner (Minister of Finance) proposals for organizing agricultural trade. The Pisani-Baumgartner plan served as the basis of the first position taken by the EEC Commission in the Kennedy Round negotiations. The Commission's plan is commonly called Mansholt I after Dr. Mansholt, the Vice-President of Agriculture for the EEC Commission.[7] Mansholt I was succeeded by

[5] See Martin E. Abel, "Price Discrimination in the World Trade of Agricultural Commodities," Jour. Farm Econ., Vol. 48, No. 2, May 1966, pp. 192-208, for a graphic analysis of such questions by a similar, though not identical, method of analysis.

[6] Samuelson, op. cit., pp. 291-294.

[7] The proposals and the background reasoning for the Pisani-Baumgartner and Mansholt 1 plans can be extracted from the following sources: Remarks by M. Edgard Pisani to Food and Agriculture Organization of the United Nations, Rome, November 1961, partially reprinted in United Nations Conference on Trade and Development, Geneva, March 23 to June 16, 1964, Proceedings, Vol. lII: "Commodity Trade" (New York: United Nations, 1964), pp. 486-487; "The Problems of Organizing the World Markets for Farm Products," Communication by M. Edgard Pisani to the EEC Council of Ministers, Brussels, June 29, 1962; "Declaration de M. Pisani, Ministre de l'agriculture, a'la 12'eme Session de la Conference de L'O.A.A." (Rome, 21 November 1963); GATT Press Release #633, Remarks by M. Wilfred Baumgartner, Minister of Finance and Economic Affairs for France, made in the Ministerial Meeting on 27 November 1961, "Information Service European Office of the United Nations," Geneva, November 28, 1961; "Aide Memoire From the French Government Concerning Certain Questions of the Agenda of the United Nations' Conference on Trade and Development," Ministry of Foreign Affairs, France, translated February 4, 1964.

(Continued on next page)

Mansholt II[8] following criticism by the United States. The European proposals for organizing world markets proceeded from the following reasoning. Most developed nations are committed to domestic farm income support. In the pursuance of income support goals, these nations utilize nontariff restrictions as means of implementing income support policies. Thus, negotiations on tariff reductions are not meaningful for agriculture. Further, developed nations have a responsibility to assist lesser developed nations. In particular, food surpluses represent a maldistribution of products rather than of resources. In general, then, the major participants in Temperate Zone trade, i.e., the United States, Canada, etc., and the EEC, should be reasonable and agree on an international arrangement consistent with these conditions.

Given the above reasoning, the various fixed-price schemes have had, with variations, the following main elements:

(1) A world price somewhere between EEC and U.S. support levels should be agreed upon by the major participants. The precise level of agreed price, however, declined with each succeeding plan, but even Mansholt II envisioned an agreed-on world price somewhat above present world prices.

(2) Exporters would be guaranteed the same total revenue as under previous trading arrangements, i.e., a smaller quantity sold at a higher price. This in turn would require market quotas for major exporters.

(3) Excess supplies over and above commercial sales should be sold to underdeveloped countries at concessional prices, presumably at the expense of the exporters. Details of how this was to be administered were never spelled out, though reference to international commodity agreements was made by both Pisani and Baumgartner.

(4) Some form of international organization, or at least formal procedures of negotiation, should be established to organize the world market for food.

These plans lend themselves to graphic analysis as shown in figure 2. For expositional purposes, the plan will be called the Pisani plan, but the central features--fixed prices and surplus disposal--are common to all. In the upper half of the figure, supply and demand functions for the EEC and the United Kingdom are shown in (a) and (b), and a world demand function is derived in (c). In the lower half of figure 2, similar constructions are presented for Canada and the United States. While this does not represent the total market for wheat, for example, it does illustrate the implications of the Pisani plan for the major types of exporters and importers; those importing at world price (United Kingdom); those importers applying tariffs (EEC); those exporters passing export prices back to producers (Canada); and those exporters maintaining domestic prices above world price (the United States).

Assume that some world price, Wp^o, prevailing because of existing arrangements, exists in time t_0. Now assume that in time t_1 the Pisani plan is implemented with agreed-on price Pp and that other things remain equal. Now it is possible to consider the effects on each country. In the EEC, target price is P1, which fixes production and consumption and determines a quantity imported, Q1. At Wp^o, the EEC gains tariff revenue of the quantity A + B. At Pp, tariff revenue declines to A with revenue B going to the exporters. Thus, the EEC loses tariff revenue, while expenditures, consumer prices, and imports remain unchanged. If, however, certain countries such as France exported the commodity, the loss in levy revenue could be offset by reduced export subsidies.

In the United Kingdom domestic support is Po, and q4 is produced. At Wp^o, q2 is consumed,

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Footnote 7 continued:
Also see discussion of Pisani plan in J. H. Richter, Agricultural Protection and Trade: Proposals for an International Policy (New York: Frederick A. Praeger, 1964), pp. 73-83; T. K. Warley, "Agricultural Policy in Europe," Grain Rev. (published quarterly by the Winnipeg Grain Exchange), Vol. 3, No. 2, Apr. 1965, p. 3; and Warley, "Organizing World Trade in Temperate Agricultural Products," Farm Mangt. Notes, Univ. of Nottingham, No. 33, Spring 1965, pp. 34-36.

[8] See address by Dr. S. L. Mansholt, Vice-President of the EEC Commission, to the European Parliament, Strasbourg, 7 January 1964, EEC Doc. No. 414/pp/64-E; also see Warley, "Organizing World Trade in Temperate Agricultural Products," Farm Mangt. Notes, Univ. Nottingham, No. 33, Spring 1965, pp. 36-38; and European Communities--Joint Information Service, "From an EEC to a World of Agricultural Policy," Newsletter on the Common Agricultural Policy, No. 30, March 1965, for details.

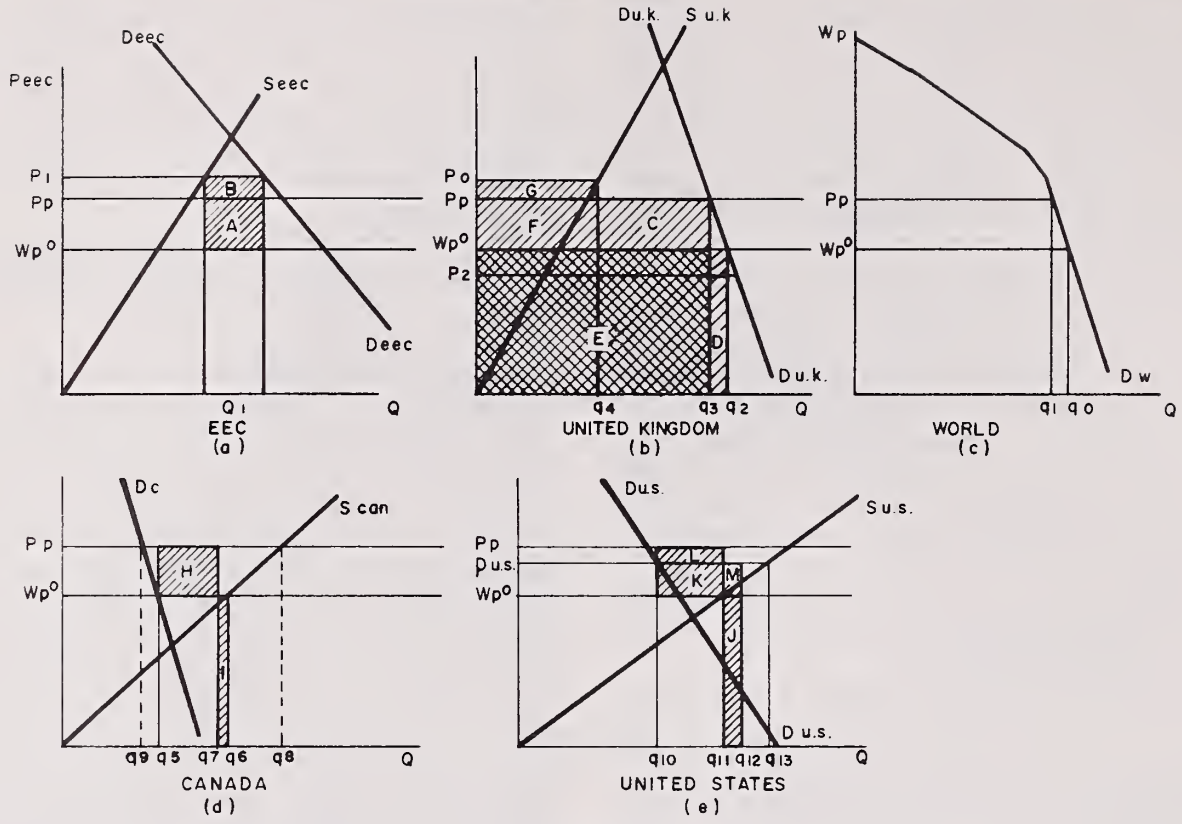

Figure 2

consumers spend E + D, and under prevailing deficiency payment programs, the government pays F + G in direct payments to farmers. Now with the Pisani plan, Pp prevails in the world market. Production remains the same but consumption contracts to q3, consumer expenditure now is E + F + C, increased by F + C - D, and government payments are reduced by F. The net loss to the country is C - D which is transferred to exporters. But food prices have risen and part of the burden of price support has been shifted from the treasury to the market place. In summation, Britain loses because of the Pisani plan; producers are unaffected but consumers will pay higher prices for less food.

In figure 2(d) Canada has passed world price Wp^0 back to producers with the result that q6 is produced, q5 is consumed, and q6 - q5 is exported. With the implementation of the Pisani plan two critical elements are demonstrated in Canada's case. First, the contraction in the quantity of imports demanded, as a result of higher prices in Britain and other importers, must somehow be allocated between exporters. Just how this is to be done was never spelled out and represents an administrative problem of some magnitude. However, assume that Canada's share of the loss is q6 - q7. The second problem arises with respect to which price, Pp or Wp^0, should prevail in the Canadian market. If Canada lets her domestic price rise to Pp, then production expands to q8, consumption contracts to q9, and given her export allocation of q7 - q5, Canada has quantities (q8 - q7) + (q5 - q9) which she must dispose of elsewhere. On the other hand, if Canada maintains her market price at Wp^0 by an export tax, then she gains H - I in revenue under the plan and can use this revenue to dispose of q6 - q7 in the concessional market. The implications of this discussion of Canada's position are the same for exporters whose domestic price is world price. The fixed price can be prevented from affecting domestic price by an export tax, or if the world price is allowed to

prevail internally, its effects can be offset either by domestic supply control or by foreign surplus disposal.

The position of the United States is depicted in figure 2(e). Domestic price is Pus, q10 is consumed, q13 is produced, q12 - q10 is exported commercially at a subsidy cost of K + M, and q13 - q12 is either stored or disposed of by concessional sales. Under the Pisani plan commercial exports are reduced to q12 - q11 (under some assumed quota allocation), revenue increases by K + L - J, and government subsidy expenditure ceases. The additional quantity, q12 - q11, must now be disposed of in other fashions. If the Pisani price assumed here were to be above the prevailing U.S. support price, then the United States would face problems similar to those of Canada.

In figure 2(c), as price is raised from Wp^{o} to Pp, the quantity of imports demanded contracts from q0 to q1, reflecting the contraction of imports in the United Kingdom and wherever else the price was previously below Pp. The elasticity of this function is critical to the group of fixed-price plans under discussion. The crucial assumption of these plans was that, if world prices were raised, revenue would be increased sufficiently to guarantee exporters the same revenue for smaller exports with excess funds available to subsidize concessional sales. If this is to come to pass, the import demand function must be inelastic over the relevant price range. Import demand functions derived by the subtraction of domestic supply from domestic demand will have at least the elasticity of the domestic demand function if the domestic supply relation is perfectly inelastic. Given a domestic supply function with some slope, it follows that the import demand function will have a greater elasticity at each price than the domestic demand function.[9] Though a definite answer as to the elasticity of the import demand function would require actual estimates of domestic elasticities, it can be stated that it will not necessarily be inelastic even if the relevant domestic functions are inelastic over the appropriate price ranges. The equation:

$$(1) \qquad Ei = \frac{Es \cdot Q - Ed \cdot q}{Q - q}$$

expresses the relationship between the elasticity of domestic supply, Es, the elasticity of domestic demand, Ed, and the elasticity of import demand or export supply, Ei, where Q is the quantity supplied domestically, and q is the quantity demanded domestically.[10]

If we define a self-sufficiency ratio, S, as the ratio of quantity supplied domestically to the quantity demanded domestically, $\frac{Q}{q}$, then (1) can be rewritten as:

$$(2) \qquad Ei = \frac{S \cdot Es - Ed}{S - 1}$$

If it is assumed that $Ed < 0$ (i.e., the demand curve slopes downward), $Q > 0$, and $Es > 0$, then it is clear from (2) that for $0 < S < 1$, $|Ei|$ increases as Es, $|Ed|$, and S grow larger. Thus, even if both domestic supply and demand were inelastic, a sufficiently large S would yield an elastic net demand function, e.g., if Es = .1, Ed = -.1, and S = .9, Ei = -1.9.[11]

If the import demand function is elastic, then the raising of world price under the Pisani plan would reduce total revenue, and everyone would lose.

Finally, the concessional market is assumed to be a completely elastic safety valve for production in excess of commercial demand.

[9] See Abel, op. cit., p. 197.

[10] See T. O. Yntema, A Mathematical Reformulation of the General Theory of International Trade (Chicago: Univ. Chicago Press, 1932, p. 44).

[11] For alternative formulations of (2), see C. E. Ferguson and M. Polasek, "The Elasticity of Import Demand for Raw Apparel Wool in the United States," Econometrica, Vol. 30, No. 4, October 1962, p. 673; and A. C. Harberger, "A Structural Approach to the Problem of Import Demand," Amer. Econ. Rev., Vol. 43, No. 2, May 1953, ff. 3, p. 156. The difference in sign is explained by their defining

$$Ed = -\frac{dq}{dp} \cdot \frac{p}{q}$$

While this article cannot delve into the questions of the desirability of food as a form of economic aid, the physical capacity of underdeveloped nations to absorb increases in food supplies, and the means by which such a program would be administered, it is clear that they are critical to the operation of these plans.[12]

Conclusions

The above analysis clearly shows that a world characterized by fixed internal and international prices is a nonequilibrium world where surpluses (and, possibly, shortages) are normal rather than abnormal. In appraising the strengths and weaknesses of proposals for such a world order, it should be recognized that the present situation, even after the Kennedy Round, is characterized by fixed internal prices and managed international prices in many instances. This situation is also one of nonequilibrium in the economic and, perhaps even more, in the political sense.

The simple graphic analysis presented here suggests that, from a typical cost-benefit viewpoint, the fixed-price schemes do not necessarily yield positive gains, even for their principal proponent, the EEC. Participants in the international agricultural policy debate should be aware of this fact, but they would be unwise to accord it more weight than it deserves.

To date, no attempt has been made to assess the absolute level of costs. Perhaps of greater importance, no one has attempted to assess the benefits to be derived in a longer run economic and political sense. If a policy reflects recognition that surplus agricultural resources in developed nations are an international as well as a domestic problem; if the mechanics of such a policy can reduce conflicts between domestic and international objectives among developed nations; and, finally, if the policy can be used to aid, or at least not to thwart, the ambitions of the developing world, an increased cost should not arbitrarily deter its adoption. Some version of a fixed-price scheme that resolves the difficult administrative problems (e.g., market shares and international financing of surplus stocks) may be such a policy.

[12] For a brief discussion of these questions, see W. W. Cochrane, The City Man's Guide to the Farm Problem (Minneapolis: Univ. Minn. Press, 1965, pp. 100-106).

Book Reviews

Techniques of Economic Forecasting

Organisation for Economic Co-operation and Development. 173 pages. Paris, 1965. $3.75.

THIS IS NOT a "how-to-do-it" or even "how-it-is-done" monograph. It resulted, according to the preface, from a discussion meeting of Government economists arranged by the Organisation for Economic Co-operation and Development for the purpose of comparing methods and procedures of forecasting. Seven countries--Canada, France, Germany, the Netherlands, Sweden, the United Kingdom, and the United States--participated in the meeting. Only short-term methods of forecasting National Income and Product were presented and discussed. Of the seven participating countries, all except Germany agreed that their presentations might be published, some after certain modifications resulting from the discussions at the meeting.

The monograph consists of these six accounts of forecasting methods plus an excellent introductory chapter by C. W. McMahon. In addition to summarizing the six "country chapters," he relates numerous points and ideas that came up during the discussion sessions but that are not included in the "country chapters."

The forecasting detail revealed in the country chapters varies widely. France, for example, takes only 5 pages to describe its forecasting methods, while the Swedish account takes 42 pages or about 20 percent of the total book. The chapter on Swedish methods is extensive because numerous multiple regression equations are presented which are used to estimate the various components of the National Income and Products accounts, i.e., imports, investment, etc. Such detail is not given in the other chapters.

Although the basic data framework for making forecasts is quite similar for all countries, the level of aggregation and sector emphasis is quite different. Differences apparently are due to practical considerations. For example, countries such as Sweden and the United Kingdom, whose economies. depend heavily on foreign trade, seem very meticulous in making forecasts of imports and exports. Another reason may be that certain sectors are much more volatile over time. Consequently, extensive analysis is required for a given level of precision in the estimates.

A unique feature of chapters on the forecasting methods of Sweden and the Netherlands is the comparison of forecasts with outcomes over a number of years. However, in the chapter for the United States, some measures of the forecasting errors are presented in relative terms.

Econometricians should be encouraged by the increasing precision over time of the forecast made by the Central Planning Bureau of the Netherlands (this bureau is responsible for making the official Netherlands forecast). Forecasts for the Netherlands are made primarily on the basis of a formal econometric model. Other countries, except the United Kingdom, use econometric methods to a lesser degree. These methods include simultaneous equations and input-output analysis. Apparently in no country do even partial mechanistic methods receive complete trust. The U.S. chapter, page 150, states: "No forecaster should accept the verdicts of a formal model without careful and continuous examination and cross checking against informal judgment." Even in the Netherlands, the model is not used "mechanically." "The model outcomes are always checked on the basis of any additional information" (page 75).

In reading the accounts of various country forecasting methods, one is struck by such recurring terms as "iterative procedure," "successive approximations," "inaccuracies of data," "informed judgments," "first, second, and third stage forecast." This fact is both encouraging and consoling. It is encouraging because forecasting jargon, concepts, and techniques have been well disseminated throughout

the highly industrial countries, and consoling because forecasters in other countries experience similar forecasting problems.

This book could have been much improved, from this reviewer's viewpoint, if the architects had insisted on similar construction and presentation in each of the chapters. Specifically, each of the chapters could have included a description of each item in the forecast, a precise explanation of how it is forecast (if possible), and a table showing both the forecasts and the outcomes over some period of time. This procedure would have permitted other forecasters to compare techniques and arrive at tentative conclusions on whether survey, eclectic, econometric, or a combination of techniques gives the best results. Of course, such a specific comparison may show that some techniques may not work best for all sectors in a country or for the same sectors in different countries. With this information at hand, prognosticators could proceed to the obvious question "why?" and hopefully move on to improve current methods.

It would have been helpful, too, if the author (authors) had been given for each of the country chapters. The chapters apparently are the result of group efforts. A list of persons who could be contacted concerning methodology and other questions would have been extremely useful.

In spite of its limitations, most economists who are interested or involved in forecasting work should find that the time required for reading this short book is well spent--first, because of its survey nature and, second, because of the consolation that results from the discovery of common problems. This recommendation also applies to those who are making forecasts in areas other than National Income and Products accounts. The problems appear to be the same, only the numbers differ.

Policy makers and advisers, too, may be encouraged by reading this book to further support research and forecasting methods because (1) improved forecasts are needed and (2) current successes lead to hope for the future.

Alvin C. Egbert

Campaigns Against Hunger

By E. C. Stackman, Richard Bradfield, and Paul C. Mangelsdorf. Harvard University Press, Cambridge, Mass. 321 pages. 1967. $7.50.

MOST BOOKS on agricultural development emphasize the contributions of one discipline or facet of development to the exclusion of others. Campaigns Against Hunger is no exception. It is an account of the overseas agricultural programs of the Rockefeller Foundation by three men who have been closely associated with them since their inception in 1943. The authors, despite their highly scientific orientation, avoid the scientific jargon which so frequently limits the appeal of books written by specialists. As a result, they have produced a very readable book which highlights the magnitude and complexity of adaptive research in plant genetics and cultural practices.

The successes of the foundation program, the authors demonstrate, arise from delineating a problem, tackling it with adequate resources, and sticking with it until it has been resolved. The resolution requires not only that immediate technical difficulties be overcome but also that a viable indigenous organization for solving future problems in the same field be established.

The widely heralded successes of the Rockefeller program in research on food grains were gestating in Mexico during the same period, 1942-53, that the U.S. Department of Agriculture was organizing and managing cooperative experiment stations in several other Latin American countries. These stations were largely prohibited from work which would encourage the development of crops that would compete with U.S. export crops--including food grains. They developed high-yielding and disease-resistant strains of cacao, rubber, pyrethrum, bananas, hard fibers, and coffee which have contributed greatly to the export earnings of Latin American and African countries since the Second World War. A comparison and evaluation of the inputs and outputs of research programs by these different types of organizations should be valuable to development planners. This reviewer's impression is that the private

agency, unhampered by political considerations, was able to focus manpower and resources more consistently.

While Henry A. Wallace is recognized as a strong influence in persuading the Rockefeller Foundation to start its agricultural program in Mexico, the continuing cooperation of the U.S. Department of Agriculture and the land grant colleges in providing consultation and laboratory testing facilities, and releasing topnotch scientists for work with the foundation, gets only offhand mention.

The authors appear to be completely sold on the research-education-extension formula for solving the world's food problems. While they concede that the adoption of new practices lags far behind research findings they ascribe this to inadequate extension. Little note is taken of economic influences. Victory in the war on hunger will not come easily. It will require coordinated campaigns of many disciplines. The more communication between the disciplines and the more appreciation each can develop for the contributions of the other, the fewer mistakes will be made. Campaigns Against Hunger is a valuable contribution to improved understanding as well as a record of progress and a ready reference for the nonspecialist on the state of knowledge in worldwide adaptive research.

Jane M. Porter

Twenty-Six Centuries of Agrarian Reform: A Comparative Analysis

By Elias H. Tuma. University of California Press, Berkeley and Los Angeles. 309 pages. 1965. $6.95.

THE HUE AND CRY over land reform that resounds in the news media and is continually emphasized in speeches in the United Nations creates the impression that the problem is a modern one associated with developing countries. Actually, land reform has been an economic and political issue since the dawn of western civilization.

The study of agrarian reform is an important topic for scholarly pursuit. It has always been much in the center of the dynamics of social order, but its objectives and impact were, for the most part, never clearly understood. This book helps towards eliminating some of the misunderstandings. Elias H. Tuma, Assistant Professor of Economics at the University of California, Davis, attempts to define the problems of agrarian reform and relate them to historical case studies in ancient Greece, Rome, England, France, Russia, Mexico, Japan, and Egypt. Unfortunately, due to lack of adequate data, the author was unable to comment on the current important agrarian reform programs in China, Iran, and Cuba. The book concludes with an evaluation of the aims of agrarian reform movements.

A difficulty in understanding agrarian reform lies in the general confusion as to the meaning and objective of the movement. The author recommends that the term, agrarian reform, replace the traditional one, land reform, since the former term goes beyond land redistribution and deals also with the pattern of cultivation, the terms of tenure, and the manner of operation.

Agrarian reform has had many objectives, and has utilized many means to achieve them. Reforms were enacted for one or more of the following reasons which are closely interrelated: (1) to reduce concentration of land, wealth, and income, (2) to loosen the rigidity of social institutions that tend to inhibit economic and social development, and (3) to promote political stability and thereby thwart revolution. Historically, agrarian reform movements have failed to be overwhelmingly successful, primarily because of the varied means by which they have been carried out. Traditionally, western countries emphasized one method, while eastern countries emphasized another. The author calls the two methods Class I and Class II reforms.

Class I reformers believe that increases and decreases in State power go hand in hand with decreases and increases in individual freedom. To preserve individual freedom and insure political stability, class conflict should be contained by a system of checks and balances which would regulate but not eliminate conflict. This reviewer finds it difficult to follow

the author's reasoning that conflict rather than harmony is the source of political stability. To be sure, conflict is not to be feared in a society when the conflicting parties negate the pressures of each other by countervailing power; however, unrestrained conflict could never produce a stable society.

It is important to be aware that in keeping with the objective of individual freedom, agrarian reforms necessarily limit redistribution of land and lead to small-scale farming. This tends to reduce efficiency. In most cases in which reform had positive economic effects, the change was brought about by moving in the direction of large-scale operation.

Class II reformers believe that land is a means of production which is used for class exploitation if privately owned. Therefore, private ownership of land and other means of production should be abolished to prevent exploitation. Furthermore, these reformers assert that compensation should not be paid for expropriated property. The payment of compensation not only tends to maintain the structure of wealth and income which the reform seeks to destroy, but also validates the principle of private property. However, as studies of reform in ancient Greece, England, and Czarist Russia would show, landlords, once compensated, were less reluctant to confer freedom on tenants or subjected peasants.

The fundamental objectives of agrarian reform are usually economic, but political considerations prevent them from achieving their desired state. Reform from the days of Solon of ancient Greece to the current Egyptian movement showed that the peasants ended up with little more in return for their support of the political regime than they had when the movement started. The reason evidently lies in the fact that throughout the reform process compromises enter into the program. Modified reform policies generally entail the use of double standards which are discriminatory in character and create an atmosphere for chaos and instability.

One can conclude that the aspirations of agrarian reform are more quixotic than are generally believed. Reform may be useful in obtaining short-term political and economic goals; however, unless a middle class is created and efficiency in farming attained, there can be no guarantee that social stability will prevail or that long-term development goals will be realized. The former objective may be possible only if the reform can substantially equalize wealth, but this would necessitate winning the cooperation of the landed interest. But with compromise the objectives are distorted and the program cannot become a complete success.

The book serves a most useful purpose by stimulating persons interested in the land grievances of rural populations to become aware of the limitations of agrarian reform movements.

Jack Ben-Rubin

The Agricultural Revolution, 1750-1880

By J. D. Chambers and G. E. Mingay. Schocken Books, New York. 222 pages. 1966. $9.50.

THIS IS AN UP-TO-DATE summary of the history of agriculture in England by two outstanding scholars in the field. Although it is designed, according to the authors, for students and teachers in universities and colleges of education, anyone interested in the subject will read it with pleasure and find it a good reference source. The title is somewhat misleading as to the period covered. The introduction and first chapter summarize the course and state of agriculture from medieval times to 1750. The remaining chapters are topical and cover improvement in the 18th century; the new farming that resulted; enclosure; cycles of prosperity and depression; the corn laws and their relation to the landed interest; high farming, with its technological changes; and, in conclusion, the relation of the agricultural economy to the whole economy. The book is well documented and indexed with suggestions for further reading at the end of each chapter.

Helen H. Edwards

U.S. GOVERNMENT PRINTING OFFICE : 1967 O—279-249

Getting Agriculture Moving, Essentials for Development and Modernization

By Arthur T. Mosher. Published for the Agricultural Development Council by Frederick A. Praeger, New York. 191 pages. 1966. $6.50.

THE AUTHOR SAYS that "the purpose of this book is to state as clearly as possible the elements that go into making agriculture more productive, and to show how these elements affect each other and depend on each other.... Getting Agriculture Moving presents an over-all review of the bare minimum that every technician, field worker, administrator, planner, and legislator needs to know about the total process of agricultural development." This is a book for the layman and for the technical specialist who needs a broader frame of reference than that provided by his specialized training. To supplement this basic book the Agricultural Development Council has prepared a Manual for trainees and teachers and two volumes of selected readings. However, the book stands alone very well. It is simple enough to be understood by people with no more than a secondary school education. It is attractive in format and has well-selected illustrations. The facts and ideas are common knowledge to those experienced in economic development. This book is a valuable addition to the rather limited literature available for use in orientation programs for technical assistance personnel. It deserves a wider audience among responsible citizens than the title would indicate.

Wayne D. Rasmussen

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